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Planning for climigration: a framework for effective action

Authors

Tony MATTHEWS[1]* and Ruth POTTS[2]

*Author for correspondence

Authors contact details

1. Corresponding author: Dr Tony MATTHEWS, Lecturer, School of Environment and Science, Griffith University, Nathan, Queensland 4111, Australia.
   Email: t.matthews@griffith.edu.au; Phone: +61 (0)7 3735 4086

2. Dr Ruth POTTS, Lecturer, School of Geography and Planning, Science and Engineering, Cardiff University, Cardiff, CF10 3WA, Wales.
   Email: pottsr1@cardiff.ac.uk; Phone: +44 (0)29 2087 5281

1. Introduction

The concept of 'climigration' describes "a specific type of permanent population displacement that occurs when community relocation is required to protect residents from climate-induced biophysical changes that alter ecosystems, damage or destroy public infrastructure and repeatedly endanger human lives" (Bronen and Chapin 2013, p. 9320). Climate change impacts now pose increasingly severe threats to the viability of human settlements. In some instances, chronic and severe impacts may render settlements unviable, leaving climigration as the adaption option of last resort. Climigration is no longer a concern for the future; it is an emerging and urgent contemporary challenge. To illustrate, the United States Department of Housing and Urban Development (HUD) provided $1 billion in grant funding in 2016 to help communities in 13 states to adapt to climate change. One grant, worth $48 million, is the first direct allocation of federal funding to move an entire community (Daveport and Robertson 2016). The residents of the Isle de Jean Charles in Louisiana will become the first community in the US to undergo federally sanctioned climigration.

Scholarly conversations on the interdisciplinary nature and character of climigration are already underway in this journal (cf., Cheong 2011; Maldonado *et al.* 2013; Sovacool 2012) and elsewhere (Leckie 2014a). Our paper adds to these early but critical discussions by providing a land-use planning framework for effectively organising and responding to the governance, policy, institutional and practical implications of climigration. We argue that land-use planning systems are likely to emerge as lead agencies in managing climigration events in many cases. As yet there is limited exploration of the nexus between climigration and land-use planning, so this paper also addresses an urgent knowledge gap. The wide scope of spatial dynamics means many planning issues are best understood through inter-disciplinary engagement. Specializations within land-use planning, including public health, housing, urban design and community development, benefit from inter-disciplinary inputs (Friedmann 2008; Levy 2017, p. 4). Delivering climate change adaptation through land-use planning similarly benefits from inter-disciplinary engagement (Matthews 2013). So too will land-use planning's capacity to respond to climigration.

We conceptually frame climigration as an end-point of climate adaptation. This is based on the view that climigration is the most extreme form of transformational adaptation. Our findings derive from a multi-disciplinary systematic quantitative literature review (Petticrew 2001; Pickering & Byrne, 2014) of scholarly journal articles that document successful and unsuccessful community relocations undertaken in response to environmental problems. We

aim to establish a hierarchy of governance factors relevant to climigration led by land-use planning systems. It should be noted that planning governance frameworks are unlikely to be solely responsible for climigration response; instead they are likely to interact and work in partnership with other governance frameworks from different institutional realms. However the focus of this paper is specifically on depicting the nature and character of land-use planning governance frameworks rather than interrogating their broader interactions with other external frameworks. Governance factors for land-use planning are divided into three tiers: those with critical, moderate or negligible implications. These factors are directly linked to the roles, processes and functions of land-use planning systems. The implications of these factors for planning systems are critically and reflexively interrogated. We offer three interlinked conclusions. The first is that land-use planning systems have capacity to respond to climigration as an extreme form of climate change adaptation but will require dynamism, fluidity, deliberation and strategy to be successful. The second is that anticipatory policy frameworks offer the greatest advantages in for climigration planning. The third conclusion is that maladaptation is a potential but avoidable threat connected to climigration events coordinated or managed by land-use planning systems.

2. Community relocation in literature

This paper focuses on climigration a form of climate change adaptation that involves community relocations. The term 'community relocation' describes the planned movement of communities of people, along with the infrastructure and structures that support them, away from environmental hazards to less vulnerable locations (Coppola 2011, p. 215). Climigration provides opportunities for planned retreat away from untenable locations and situations (Bronen and Chapin 2013; Maldonado *et al.* 2013). Climigration events may involve permanently relocating entire communities or large sections of them. Climigration is a form of forced migration, as it occurs in response to threats to lives or livelihoods connected to climate change impacts (IOM 2011, p. 39). It is also a form of assisted migration because it is undertaken in a planned and structured way, generally with the assistance of governments and agencies of government (IOM 2011, p. 11). Once climigration occurs, it is highly unlikely that the original community will ever permanently return to its prior location. Climigration is therefore a form of community relocation, albeit in a unique sense, as it can only occur where climate change impacts constitute the driving force.

The literature concerned with adaptive community relocation is currently limited, but is expanding as scholarly interest increases. There are currently two main streams. The first empirically documents the observed experiences of planned community relocations (David

and Mayer 1984; Leckie 2014a; Oliver-Smith 1991; Shriver and Kennedy 2005). For example, David and Mayer (1984) examined the relocation of Soldiers Grove, Wisconsin. In 1976 the village board of Soldiers Grove decided to relocate the business district of the town to protect it from flooding, despite a proposal from the US Army Corps of Engineers to fund levees. The community resisted the construction of levees, as their annual operation and maintenance costs were to be borne by the village and would have used up the majority of annual property tax revenues. A major flood in 1978 provided further impetus for relocation. David and Mayer (1984) found that the relocation produced numerous positive socio-economic outcomes including increased economic activity, improvements to building stock and an increase in community population size.

A cross-national study by Oliver-Smith (1991) documents community relocations following earthquakes in Turkey, Iran, Guatemala, and Peru. The work provides three over-arching findings. The first is that relocations are generally more complex than initially recognised by disaster management agencies. The second is that practitioners see relocation as a last chance and undesirable adaptation approach. The third is that forced relocations are likely to fail if the victim population resists external decisions made without their consultation or consent. Oliver-Smith's analysis also records some drivers for successful and unsuccessful relocation efforts. Drivers for success include: sufficient economic resources; strong social capital with affected communities; provision of suitable new housing with room for future expansions and; the creation of employment opportunities. Drivers of failure include: poor site choices, distance from essential resources, and; poor design and construction of new housing.

The strong potential for conflicting community perspectives to delay relocation is documented by Shriver and Kennedy (2005). In this case, the town of Picher, Oklahoma was jointly designated for relocation by the Environmental Protection Agency and the State of Oklahoma. Picher was suffering from severe contamination of its ground waster due to toxic metal contamination. Environmental contamination became a severe problem despite remediation efforts. The decision to relocate the community generated significant contention. Much of this focused on how community members perceived risks associated with the contamination. Two distinct community groups formed. The 'Steering Group' supported relocation efforts. They campaigned for relocation using a proposed federal buyout, citing serious environmental and health problems as catalysts for relocation. The 'Speak Out' group opposed relocation, arguing that the problems were overstated. They also focused on the loss of cultural connection to the town. Shriver and Kennedy argue that both groups held valid positions, based on opposing views within common themes. They refer to this as connected to opposing perceptions of risk.

The second stream of community relocation literature provides guidance for relocation initiatives (Abel *et al.* 2011; Bronen and Chapin 2013; Niven and Bardsley 2013). Bronen and Chapin (2013) describe the experiences of three communities in Alaska whose viability was threatened by extreme weather events and climate-induced coastal erosion. A key finding is that the absence of overarching institutional relocation frameworks meant that relocations occurred in an ad-hoc manner. Each community employed different approaches to their relocation planning. The lack of clear institutional frameworks meant the communities faced a myriad of problems. These included: legal issues around land acquisition to establish new communities; establishing funding arrangements for new infrastructure; choosing culturally appropriate locations to move to and; matching government and community criteria with respect to site suitability.

The literature providing guidance for future community relocations builds on lessons from prior relocation experiences to provide a basis for the development of institutional frameworks designed to guide adaptive community relocations. A common theme is that developing processes designed to facilitate community relocation is fraught with difficulties (IFC 2002; FEMA and APA 2005; Imura and Shaw 2009). In particular, a lack of institutional frameworks capable of providing a governance basis for relocating communities is regarded as an impediment to community relocation (Abel *et al.* 2011; Bronen and Chapin 2013; FEMA and APA 2005; Maldonado *et al.* 2013). The implications of this are potentially damaging as already stressed communities may face the further challenge of being relocated in uncoordinated ways. Coherent and flexible institutional frameworks, designed to provide effective coordination of community relocations, can offer significant advantages in cases of climigration. Ideally, frameworks should be capable of fast-tracking development applications, approving demolitions, and providing temporary housing, access, transportation and services to affected residents (FEMA and APA 2005).

3. Conceptualising climigration as an end-point of adaptation

We advance a conceptual perspective in this paper that climigration represents an end-point of climate adaptation. Climate change adaptation involves direct action to limit and manage negative climate change impacts (Adger, Arnell and Tompkins 2005; IPCC 2014). Adaptive strategies are developed and delivered in order to adjust human and natural systems to moderate harmful climate change effects of to gain from any beneficial opportunities they may offer (IPCC 2014, p. 118). Successful climate adaptation strategies reduce vulnerability to climate change impacts in human settlements. Two categories of adaptation exist in

literature (IPCC 2014). The first is incremental adaptation, which aims to maintain the essence and integrity of a system. The second is transformational adaptation, where adaptive actions change the fundamental attributes of a system.

Climigration goes beyond incremental adaptation because the essence and integrity of a community will be lost, or at least profoundly changed, if it is relocated. A physical relocation is a type of 'hard' adaptation that will inherently alter the nature and character of any community (Sovacool 2012). Granted, a community may be successfully relocated and its residents may be content with their new location, housing and infrastructure. Notwithstanding, the essence and integrity of the community will have changed substantively even if high levels of social capital remain. Climigration is transformational adaptation because it involves radical efforts to manage negative climate change impacts. This adaptive action will extensively change fundamental attributes of the relocated community. Conceptually, it is the most extreme form of transformational adaptation. Abandoning a community, the opposite extreme response, is not an act of adaptation because it does not manage climate change impacts; rather it concedes to them. The relocation of a community to protect it from climate change impacts therefore represents a conceptual end-point of adaptation because there cannot be any further form of response beyond it. As such, we argue that climigration can be conceptually understood as an end-point of adaptation.

4. Methods

This paper employed a systematic quantitative literature review to categorise and analyse case studies of community relocation in response to environmental problems. Governance factors that influence the success or failure of such initiatives were categorised in order to understand their implications for climigration. Systematic literature reviews involve the systematic categorisation of relevant academic literature, enabling an objective analysis of the literature, its key themes and gaps in knowledge (Petticrew 2001). It is used widely in the ecological, medical, and social sciences and pays particular attention to the patterns of themes that emerge from analysis (Petticrew 2001; Pickering and Byrne 2013; Roy, Byrne and Pickering 2012). Systematic literature reviews differ from meta-analysis in that 'results of the reviewed literature are not used as data for further statistical analysis' (Rupprecht and Byrne 2014, p.599). Rather, information pertaining to each paper's characteristics (e.g. publication discipline, research category) and content (e.g. case study typologies, categories of findings, information specific to relocation) is recorded. This enables a methodologically rigorous synthesis of trends in the literature and its discussion of a particular topic or issue (Petticrew 2001; Pickering and Byrne 2013; Roy, Byrne and Pickering 2012; Pickering and Byrne

2014). It should be noted that findings from a systematic quantitative literature review might appear vague if there is only a limited volume of literature is available to analyse. Nonetheless, the findings are valid and rigorous if all appropriate literature is harvested and systematically and quantitatively reviewed.

Eligible literature from a spectrum of disciplines was found through a systematic search of peer reviewed academic journal articles in Google Scholar using combinations of the following exact terms: community relocation; community relocation and planning; community resettlement; community resettlement and planning; disaster relocation; disaster relocation and planning; climate change relocation; climate change relocation and planning. The search parameters were not time limited. Identified papers were systematically screened according to whether or not they examined, discussed or referred to planning factors influencing community relocation in a case study context. Papers that discussed resettlement in terms that did not include community relocations were screened out, ie, papers related to development, conflict, etc that only discussed resettlements of people and did not include consideration of moving housing stock or infrastructure. Papers were initially screened using their abstracts, followed by a more in-depth analysis of papers with relevant abstracts. Papers were excluded if they described instances of temporary relocation, or if they did not discuss or refer to planning factors influencing relocation in specific case study locations. Eligible papers were drawn from a diverse array of disciplines. These included planning, disaster management, environmental policy, sociology and immigration. The process produced a pool of 12 eligible papers, with many more discarded because they did not satisfactorily meet the methodological criteria.

The selected papers were systematically reviewed based on whether they discussed planning factors in cases of community relocation. The findings of each paper were analysed to identify factors identified as influential on decision-making surrounding the planning and implementation of relocation. The factors were then grouped into three categories – Critical, Moderate, Negligible – based on their prevalence and number of case studies in which they occurred. The findings are provided in the next section and illustrated in Table 1. All findings represent the information presented in each paper at the time of its publication. This study does not directly comment on community relocation experiences following the publication of any of the papers. Instead, to ensure rigour, the paper's analysis is based on only what is directly presented in the literature.

5. Findings

The overall results of the systematic literature review are illustrated in Table 1. The governance factors we identify as influencing relocation success are classified into three categories of influence in the following analysis: (1) Critical (2) Moderate (3) Negligible. Factors were identified across multiple environmental problems. The literature reveals that the most commonly cited disaster catalyst for community relocation is the threat of repeated and severe flood events.

INSERT TABLE 1 HERE

Table 1: Key factors influencing community relocations

5.1 Critical Influences

Our analysis found the primary difference between successful and unsuccessful community relocation was the degree to which the community agreed on the need to relocate in response to environmental problems (Bronen and Chapin 2013; Marino 2012; Perry and Lindell 1997; Sipe and Vella 2014). The community of Newtok, an Eskimo village in western Alaska, for example, undertook three separate votes that resulted in consensus to relocate the community to a nearby island (Bronen and Chapin, 2013). This consensus provided sufficient social capital for the Newtok community to commence relocation to avoid intensifying threats from extreme weather events and climate-induced coastal erosion. The Shishmaref and Kivalina communities of Alaska faced similar issues but were unsuccessful in their bid to relocate despite the support of residents because a lack of alternative sites proved an insurmountable barrier (Bronen and Chapin 2013).

High levels of ambiguity surrounding the dangers posed by living in a community with substantial land and water contamination limited community consensus in Picher, Oklahoma (Shriver and Kennedy 2005). Prevalent ambiguity led insufficient community consensus on the extent of environmental dangers. This undermined arguments on the need to relocate in response to the contamination issues. Some residents were highly motivated to relocate due to high levels of risk perception, while others were less risk averse and saw limited advantage in relocating. Ambiguity also undermined community consensus on the need to relocate in low-lying coastal communities studied in Australia (Abel *et al.* 2011; Niven and Bardsley 2013). The impact of sea level rise linked to climate change over coming decades is the impetus to relocate in these cases. However, ambiguity surrounding the timing and severity of sea level rise led to low levels of consensus. Our analysis strongly indicates that perceptions of risk can influence feelings of ambiguity amongst residents. This can condition the probability and extent of consensus for community relocations in some instances of climigration.

5.2 Moderate Influences

Our analysis found that strong local leadership, government support for relocation and the availability of economic resources have moderate levels of influence on the success of community relocations (Badri *et al.* 2006; Bronen and Chapin 2013; Marino 2012; Perry and Lindell 1997; Stal 2011). All of these factors featured in the case of Allenville, Arizona, which relocated as a result of recurrent flooding (Perry and Lindell 1997). The provision of funding by the Arizona Government and US Army Corps of Engineers catalysed efforts to relocate. The success in relocating Allenville was also helped by government supporting local leaders in their efforts to communicate directly with the community. This indicates that multi-faceted government support for communities seeking to relocate can be a catalyst for success.

The availability of adequate economic resources and strong local leadership can improve the capacity of relocated communities to resettle following disasters (Badri *et al.* 2006; Bronen and Chapin 2013; David and Mayer 1984; Perry and Lindell 1997; Sipe and Vella 2014). However, in some circumstances, communities relocate regardless of the financial resources available to them (Marino 2012; Stal 2011). Such relocations generally occur in emergency contexts where community infrastructure has been substantially destroyed (Badri *et al.*, 2006; Sipe and Vella 2014), or where there is a high likelihood of further and recurrent damage to community infrastructure (Bronen and Chapin 2013; David and Mayer 1984; Sipe and Vella 2014). For example, the main business district of Soldiers Grove, Wisconsin suffered significant damage following an extreme flood event (David and Mayer 1984). Relocating the town's business district became the most viable option due to the high economic costs of reconstruction, the likely cost of engineered solutions and flood-prone nature of the original location.

5.3 Negligible Influences

The factors we found to have negligible impact on the success of relocation were the degree to which the relocation was forced, whether a policy context facilitated relocation and whether there was a specific policy framework for relocations. There was limited evidence to suggest that involuntary relocations are any more common than voluntary relocations. Only three of the relocation case studies examined were involuntary (Badri *et al.* 2006; Nilsson 2010; Stal 2011). The fact that the majority of cases did not involve forceful relocation may suggest there are instances of community relocation where extent of risk outweighs all other factors, leading to involuntary relocations. Conversely, it may also suggest that communities

will generally relocate voluntarily if circumstances allow it and there is sufficient time to generate consensus.

We found limited evidence to suggest that the policy context facilitating community relocation was significant in the examined cases. Only three of the seven successful relocation case studies (Badri *et al.* 2006; David and Mayer 1984; Perry and Lindell 1997) and one of the unsuccessful case studies (Nilsson 2010) indicated that policy context had positively influenced their success. The remaining seven case studies did not cite policy context as a facilitator or limiter of community relocation. The presence of an overarching framework for relocation was found to occur equally in the successful (Badri *et al.* 2006; Perry and Lindell 1997) and unsuccessful relocation cases (Nilsson 2010; Niven and Bardsley 2013). The limited importance of policy frameworks is because relocation was highly reactive in most of the examined cases. Arguably, an amenable policy context, combined with a specific relocation framework designed to facilitate adaptive relocations, would have further facilitated these communities to relocate successfully.

6. Discussion

Land-use planning provides "institutional mechanisms through which political communities can address their common problems about the management of environmental change in localities" (Healey 1997, p. 5). A growing body of literature focuses on the necessity for planning to respond to climate change impacts in human settlements through adaptation (Gleeson 2008; Hamin and Gurran 2009; Klein, Mantysalo and Juhola 2015; Measham *et al.* 2011; Matthews 2013). As conceptualised earlier, climigration is an extreme form of transformational climate change adaptation. Whilst climigration may not feature heavily as a planning concern at present, we argue that it is critical for land-use planning to awaken to climigration as an emerging imperative. Land-use planning systems are becoming increasingly active and sophisticated in their efforts to respond to climate change through adaptation. Considering this, we argue that many have capacity and tools to start to engage meaningfully with climigration as a nascent form of adaptation. Specific issues, processes and pitfalls associated with developing dynamic institutional frameworks to manage and facilitate climigration events are critically and reflexively discussed throughout this section.

Land-use planning systems are likely to be principal agencies in many climigration cases because of their existing institutional roles in land-use organization and change, whether prompted by social, economic or environmental conditions. Land-use planners are trained in

processes likely to feature in climigration. These include land acquisition, managing development applications and demolitions, providing temporary housing, providing transportation services and mediating competing spatial claims. Planning responses to climigration will require dynamism, fluidity, deliberation and strategy. They will also require support, guidance, leadership and strategic direction from connected disciplines including disaster management, environmental justice, social psychology, economics, law, public policy, social policy and engineering.

6.1 Consensus through consultation

Community consensus supporting relocation was evident in all but one of the case studies where relocations successfully occurred. This emphasises the importance of using community consultation as a mechanism to build community consensus surrounding the need for climigration. The potential for community consensus to emerge is increased if communities are genuinely and comprehensively engaged and consulted about climigration as a response. Community consultation is a common and long established tool employed by land-use planning to inform the public and improve support and consensus for large development projects (Shipley and Utz 2012). We suggest that land-use planners should also actively use consultation as a vital tool for trying to secure a community's consensus to relocate in the event of climigration. Community consultations can raise awareness of risks, offer residents an opportunity to actively participate in critical decisions and ultimately help secure consensus. It can also ensure that community and human rights are central to decision-making (Bronen 2011; Maldonado 2013). We caution that consultation processes should not be understood to offer any guarantee of consensus. Consultation only provides a forum for securing consensus – it does not guarantee it. Consensus must come from the community itself. We suggest there may be advantage in spatial planners liaising with representative groups. Such groups, described by Mahony (2013) as 'boundary organisations', can provide a bridge for knowledge exchange and communication between communities and outside agencies. Such organizations may operate at international, national, regional or local scales. They may include, where relevant, an Environmental Protection Agency, university research centres, public health institutes, research grant agencies and scientific/technical advisory groups (Guston et al. 2000). Involving boundary organisations can empower community stakeholders to communicate, negotiate, and deliberatively build consensus surrounding the communities' desired outcomes if correctly managed.

Relocating a community places residents under profound emotional, social, economic and cultural stress. This may create situations where stress and anxiety make residents hostile to

external actors, even if those actors are there to assist them in relocating. We suggest that community consultations in such cases run a significant risk of becoming tense, fraught and hostile. This possibility may be heightened in communities where climigration suddenly enters a community's agenda due to recent, severe impacts. Residents may be overcome with shock, anger or grief. Securing their attention and consensus may be challenging. We suggest that planners facilitating consultations related to climigration would benefit the assistance of trauma counsellors. Their expertise and training could help manage highly charged situations and mediate disputes. Planners may also benefit from assistance provided by psychologists, who can sensitively explain to traumatised residents that the disruption of relocation may be less severe than the dangers associated with remaining. Depending on circumstances, other contributing disciplines and professionals may include health, engineering, geology and emergency service workers.

6.2 Mediating relocation costs

Instances of climigration will have substantial associated costs. Some of these will be experienced by residents of affected communities, such as emotional costs associated with losing a family home. Other costs will be borne by both the relocated community and wider society. We highlight two costs we see as relevant to land-use planning. The first is the economic cost of finding suitable land to relocate a community to. Planners may be required to quickly secure new land. It is likely that funding for land purchase will come from government, with site selection placed in the domain of planners. Whilst this sounds practical, we suggest that it may become problematic. For example, planners may identify a suitable site within a reasonable distance of the current community, which offers acceptable topography, as well as proximity to roads, public transport options and utility networks. However, they may be limited in their capacity to negotiate on purchase price if they are seeking to secure that land on the open market. Government may only be willing to make a certain amount of money available, leaving planners forced to choose between what they see as the most appropriate site and other sites that offer less potential but a lower purchase price. While there are documented instances where governments have secured land banks in anticipation of future need, it is not common practice and so cannot be generally relied on by planners (Leckie 2014b). Time will likely also be factor. Communities undertaking climigration will probably not wish to be unduly delayed. As such, land purchase processes may place planners in the middle of competing forces, comprising residents' expectations, governments' budgetary limitations and the market's profit-maximising intentions. Successfully mediating these forces and costs will require planners to be strategic, determined and deliberative.

The second cost we see as relevant is cultural cost. Communities that are required to relocate face internal social costs related to losses of identity, sense of place and shared histories. Land-use planners are likely to be limited in their capacity to respond because these costs may be largely unavoidable. Nonetheless, planners should not underestimate the importance of cultural costs experienced by affected residents (Cheong 2011, Maldonado *et al.* 2013). We see a particular role for planners in mediating between the needs of relocating communities and the needs of existing communities that may be proximate to a relocation site. This challenge becomes potentially more severe if decisions are made to try and blend relocated communities with existing communities. Receiving communities may reasonably see the quick arrival of large numbers of new residents as problematic, disruptive or threatening. In this sense, a receiving community could face their own cultural costs. We suggest that planners need to be cognisant of this potential reality. They should consult with receiving communities to allay their fears, build consensus and harness their support. We suggest failure to appreciate the concerns receiving communities may feel for their cultural identities could lead to serious social disharmonies. Instances of climigration are obviously disruptive for relocating residents. However, knowing they are unwelcome in their new homes could be very socially harmful for those individuals as well as the communities that receive them.

6.3 The advantages of anticipatory frameworks

Fluid and dynamic institutional frameworks are important in cases of climigration (Bronen and Chapin 2013). We advocate that land-use planning systems should proactively develop anticipatory frameworks. These should be designed to strategically guide climigration responses if vulnerable communities are identified. Dedicated frameworks are preferable in cases where planning is required to respond to climate change through adaptation (Matthews 2011). Ad-hoc solutions are unlikely to prove superior to anticipatory institutional frameworks. In the case of climigration, anticipatory frameworks may also lessen the potential for maladaptation. We suggest that maladaptive outcomes are more likely to occur in climigration events where weak, vague, or no institutional frameworks exist. It may also occur when there is poor coordination between planning systems and other disciplines or professional agencies. Maladaptive outcomes could, at worst, increase the vulnerability of relocated communities. As such, anticipatory frameworks designed to strategically guide climigration via land use planning may improve the potential for climigration success and reduce the potential for maladaptive outcomes which intensify stresses already face by exposed communities.

We argue that anticipatory land use planning frameworks for climigration should prioritise the following: attaining community consensus; provisioning involvement from other professionals agencies and disciplines; establishing comprehensive mechanisms for managing and mediating the economic, social and cultural costs of climigration. Vulnerable communities can be identified using risk mapping. If communities are identified and climigration may become necessary, the development of anticipatory frameworks should begin as early as possible. Alternative sites can be short-listed in advance and potential logistical and infrastructural demands can be identified. Potential requirements for resources may be noted within climigration frameworks so they can be quickly actioned, should they become necessary. Specific policies can be established to provide for community consultations to be undertaken with the support of local boundary groups. Liaising with and utilising local leadership can also help allay suspicion or hostility amongst affected residents. Institutional provision for temporary housing provision, temporary road construction and infrastructural support can also be established. In addition, providing social associated support structures, such as trauma counselling, could also be provisioned through anticipatory climigration frameworks.

7. Conclusion

Climate change impacts increasingly threaten the viability of human settlements and may start to increasingly render some unviable over the coming decades. Climigration, the planned relocation of settlements exposed to extreme climate-induced changes, was conceptualised as an end-point of adaptation in this paper. That was based on the argument that there are no further adaptive responses beyond spatially relocating a community. We argued that climigration fits within the domain of land-use planning systems as an extreme form of climate change adaptation. Land-use planning systems are key government agencies, charged with developing institutional mechanisms to manage spatial and environmental change, including climate change adaptation, across scales. They routinely import and translate knowledge from other disciplines to help craft good outcomes when faced with a wide scope of spatial dynamics. Results from our systematic quantitative literature review identified and provided insights into the potential governance issues central to community relocations. We linked these to the roles, functions and processes land-use planning systems to highlight their implications for climigration planning.

We offer three interlinked conclusions. The first is that land-use planning systems are capable of responding to climigration as a form of climate change adaptation. Responses will require dynamism, fluidity, deliberation and strategy and will need to be informed by knowledge,

processes and strategy developed with input from other disciplines. Planning systems can respond but adaptive responses will need to be uniquely devised and appropriate to local professional, economic, environmental, social and cultural realities. Our second conclusion is that anticipatory policy frameworks for climigration offer much greater advantages in instances of climigration, compared with reactive responses. Climigration frameworks should include comprehensive provisions for seeking community consensus, actively engaging with community leadership, involving other professionals and agencies and providing mechanisms for mediating the many costs of climigration. Our third conclusion that maladaptive climigration outcomes are possible due to weak or vague institutional frameworks or poor coordination between land-use planning systems and other professional agencies. We argue that the surest way to minimise the potential for maladaptation is by ensuring that anticipatory climigration frameworks are devised to strategically guide climigration responses if vulnerable communities are identified in a land-use planning system's functional area.

Climigration is a relatively new concept and is not yet extensively examined from a land-use planning perspective. While our paper offers a land-use planning framework for organising and responding to climigration, it is subject to some research limitations. The first is that our systematic literature review is based on a review of scholarly journal articles that document past community relocations undertaken in response to environmental problems. As such, there are likely to be influencing factors in future climigration events that are not accounted for here. We acknowledge that the specific ways in which the factors we highlight affect land-use planning will be shaped into the future by combinations of experience, context, location and circumstance. More will be learned as these events unfold and are researched. We also acknowledge that real-world experiences will influence the nature and character of land-use planning frameworks for climigration and that shifts and changes will be better understood through future experience. Another limitation is viability. We have not explicitly discussed the circumstances under which wholesale relocation may be an option for a community. Factors such as land availability, community size and government funding may be important limiting factors. Climigration may not be a possibility for large cities and may only be viable for small towns and rural villages. It is difficult to predict when climigration will be viable in general terms as it is likely that its viability will be considered on a case-by-case basis, taking a variety of factors into account. However, we do not doubt that there will be future instances where climigration is rejected for being too much of a logistical, financial or institutional challenge. A final limitation we wish to acknowledge is around the availability of land-use planning systems. Whilst land-use planning is widely used internationally, there are still many jurisdictions where it does not exist or is weakly articulated. In such cases, it seems clear that land-use planning cannot be relied on to manage or coordinate climigration events.

Relocating vulnerable communities as an extreme form of adaptation may become more common, necessary and acceptable over time. Harm from chronic and severe climate change impacts may lead to climigration becoming the only viable option for some vulnerable communities. While climigration may not yet currently feature as a land-use planning issue, it is likely to become an increasingly urgent agenda over the coming decades. Land-use planning systems can and should begin to meaningfully engage with climigration as a nascent reality. Doing so will allow them to start developing proactive responses in conjunction with other cognate disciplines to minimise future disruptions to communities and their residents.